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1.0 OPERATIONAL DESCRIPTION

1.1 Background

On January 25, 2010, the South Dakota Department of Environment and Natural Resources (DENR) issued a Title V air quality permit to the Department of Veterans Affairs for the operation of four boilers at the Hot Springs Medical Center in Hot Springs, South Dakota. Unit #5 is subject to federal New Source Performance Standard (NSPS) Subpart Dc for small industrial-commercial-institutional boilers. In Accordance with Administrative Rules of South Dakota (ARSD) 74:36:05:03(2) this applicability required Hot Springs Medical Center to obtain a Part 70/Title V permit.

1.2 Existing Operations

Table 1-1 lists the equipment currently operated by the Hot Springs VA as found under the existing permit.

Table 1-1 – Description of Permitted Units, Operations, and Processes

DENR ID	Unit Description	Designed Maximum Operating Rate	Control Device
Unit #2	Boiler #2 - 1974 Nebraska boiler, water tube model, fired with distillate oil.	20.4 million Btus per hour heat input	Not Applicable
Unit #3	Boiler #3 - 1974 Nebraska boiler, water tube model, fired with distillate oil.	20.4 million Btus per hour heat input	Not Applicable
Unit #4	Boiler #4 - 2004 Hurst boiler fired with distillate oil.	7.5 million Btus per hour heat input	Not Applicable
Unit #5	Boiler #1 – 2008 Cleaver Brooks boiler, model CEW-101-500-150, fired on distillate oil	20.4 million Btus per hour heat input	Not Applicable

1.3 Proposed Construction

On September 7, 2011, DENR received Hot Springs Medical Center's complete application to remove Unit #2 (1974 Nebraska boiler rated at 20.4 million Btus per hour heat input) and construct and operate in its place a 2011 Cleaver Brooks boiler rated at 20.4 million Btus per hour heat input. The following is the Department of Environment and Natural Resources' (DENR's) regulatory review and emission calculations based on the specifications listed in the application.

Table 1-2 provides a description of the new boiler that will replace Unit #2 in Table 1-1.

Table 1-2 – Proposed Equipment

DENR ID	Unit Description	Designed Maximum Operating Rate	Control Device
Unit #6	Boiler #2 replacement – 2011 Cleaver Brooks boiler, model CEW-101-500-200ST fired on distillate oil	20.4 million Btus per hour heat input	Not Applicable

2.0 POTENTIAL EMISSIONS

2.1 Emission Factors

DENR uses stack test results to determine air emissions whenever stack test data is available from the source or a similar source. When stack test results are not available, DENR relies on manufacturing data, material balance, EPA's Compilation of Air Pollutant Emission Factors (AP-42, Fifth Edition, Volume 1) document, the applicant's application, or other methods to determine potential air emissions.

Boilers are classified according to their gross heat input. A small industrial boiler is classified as having a heat input capacity less than 100 million Btus per hour. The proposed unit has a capacity of 20.4 million Btus per hour and therefore fits under the industrial boiler classification.

Unit #2 and its replacement unit (Unit #6) have the same rated capacity, therefore the potential emission calculations will be identical for each and no large changes in actual emissions are expected to occur. A newer unit should be more efficient and therefore for the same steam demands require slightly less fuel and therefore produce fewer emissions.

The emission factors for the boilers burning distillate oil are derived from AP-42, Table 1.3.1, 5/10 and Table 1.3.2, 5/10 for boilers with input capacities less than 100 million Btus per hour. The State and federal emission limits for these units are in units of pounds pollutant per million Btu of heat input so DENR converted the AP-42 emission factors from units of pounds pollutant per 1,000 gallons of fuel burned to pounds pollutant per million Btu of heat input based on a distillate oil heat capacity of 140 million Btus per thousand gallons. The AP-42 values and converted values are shown in Table 2-1.

Table 2-1 – Boiler Emission Factors

Pollutant	TSP ^b	PM10 ^b	SO2 ^a	NOx	CO	VOC	HAP
Emission factor [lbs/1000 gallons]	2	1	7	20	5	0.2	0.048
Emission factor [lbs/million Btu]	0.014	0.007	0.050	0.143	0.036	0.001	0.0003

^a – Based on a distillate oil sulfur content of 0.05 percent by weight

^b – Filterable

This chapter of AP-42 was updated in May 2010 and contains emission factors for CO2 and condensable particulates as shown below in Table 2-2.

Table 2-2 – Boiler Emission Factors Continued

Pollutant	Condensible Particulates	Total PM10 ^a	CO2
Emission factor [lbs/1000 gallons]	1.3	2.3	22,300
Emission factor [lbs/million Btu]	0.01	0.02	159

- ^a – Condensables are smaller than PM10 or smaller so total PM10 is filterable plus condensable.

2.2 Potential Emission Estimates

Potential emissions are based on operating at the maximum heat input capacity, 24 hours per day, 7 days per week. DENR used Equation 2-1, each unit's listed heat input capacity, and the emission factors in Table 2-1 to determine the greatest potential emissions from each boiler. The results are displayed in Tables 2-3 and 2-4.

Equation 2-1 – Calculating Potential Boiler Emissions

$$\text{Potential} \left[\frac{\text{tons}}{\text{year}} \right] = 8760 \left[\frac{\text{hours}}{\text{year}} \right] \times \text{input capacity} \left[\frac{\text{MMBtus}}{\text{hour}} \right] \times \text{emission factor} \left[\frac{\text{pounds}}{\text{MMBtus}} \right] \div 2,000 \left[\frac{\text{pounds}}{\text{ton}} \right]$$

Table 2-3 – Potential Emissions – Boilers (tons per year)

Unit#	TSP ^a	PM10 ^a	SO ₂	NO _x	CO	VOC	HAPs
2	1.3	0.6	4.5	12.8	3.2	0.1	0.0
6	1.3	0.6	4.5	12.8	3.2	0.1	0.0
Total change in facility potential to emit	0	0	0	0	0	0	0

^a – Filterable only

Table 2-4 – Potential Emissions – Boiler (tons per year)Continued

Unit#	Condensible Particulates	Total PM10 ^a	CO2
2	0.83	1.47	14207
6	0.83	1.47	14207
Total change in facility potential to emit	0	0	0

3.0 PERMIT REQUIREMENTS

3.1 New Source Review

ARSD 74:36:10:01 notes that new source review regulations apply to areas of the state which are designated as nonattainment pursuant to the Clean Air Act for any pollutant regulated under the Clean Air Act. The Hot Springs Medical Center operates in Hot Springs, South Dakota, which is in attainment for all the pollutants regulated under the Clean Air Act. Therefore, the Hot Springs Medical Center is not subject to new source review.

3.2 Prevention of Significant Deterioration (PSD)

HSMC is considered a minor source under the PSD program and is the boiler replacement will not affect that classification.

3.3 New Source Performance Standards (NSPS)

DENR reviewed the new source performance standards and determined the following may be applicable to the proposed boiler:

3.3.1 40 CFR, Part 60, Subpart Dc - Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units

This new source performance standard is applicable to any unit that meets the following criteria:

1. The provisions of this subpart are applicable to each boiler that has a minimum design heat input capacity equal to or greater than 10 MMBtus per hour but less than or equal to 100 MMBtus per hour; and
2. Commences construction or modification after June 9, 1989.

Unit #6 will be subject to this NSPS for boilers because it was built after 1989, and is rated at 20.4 MMBtus per hour. The subpart limits SO₂ emissions from Unit #6 to 0.50 pounds per million Btus of heat input.

The applicable requirements will be the same as those for Unit #5 which are in Chapter 9.0 of the current Title V permit and includes initial notifications of startup and construction, restricts fuel burned to distillate oil, restricts sulfur content of fuel, requires recording the fuel use, monitoring its sulfur content, and semiannual reporting requirements.

3.4 National Emission Standards for Hazardous Air Pollutants (NESHAP)

Presently, there are no finalized or promulgated National Emissions Standards for Hazardous Air Pollutants standards applicable to this type of operation.

3.5 Maximum Achievable Control Technology Standards (MACT)

DENR reviewed the Maximum Achievable Control Technology standards and determined that the following may be applicable.

3.5.1 40 CFR, Part 63, Subpart JJJJJJ – National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers Area Sources

This subpart applies to industrial, commercial, and institutional boilers and process heaters located at area sources of hazardous air pollutants. The Hot Springs Medical Center is considered an area source of hazardous air pollutants and is applicable to this subpart and an 0.03 pound per million Btu emission limit.

3.6 State Requirements

In accordance with ARSD 74:36:20, Hot Springs Medical Center is required to submit an application for a construction permit since the proposed change is considered a modification under its Title V permit. Hot Springs Medical Center is required to submit an application to modify its Title V operating permit within 12 months of the first initial startup of a proposed source.

3.6.1 State Emission Limits

In accordance with 74:36:12, fuel burning units are subject to a visible emission limit of 20 percent opacity. Particulate matter and sulfur dioxide emission limits for fuel burning units are derived from ARSD 74:36:06:02. Equation 3-1 was derived from ARSD 74:36:06:02(1)(b) and is used to determine the total suspended particulate matter emission limits for Unit #6.

Equation 3-1 – Boiler total suspended particulate matter emission limits

$$E = 0.811 \times H^{-0.131}$$

where:

- E = allowable total suspended particulate matter emission rate in pounds per million Btus heat input; and
- H = heat input in million Btus per hour.

The resulting particulate limit is 0.55 pounds per million Btu, however Unit #6 is subject to a maximum achievable control technology standard of 0.03 pounds particulate per million Btu of heat input which is more stringent than the state limit; therefore, the state limit will not be placed in the permit.

In accordance with ARSD 74:36:06:02(2), the sulfur dioxide emission limit for fuel burning units is 3.0 pounds per million Btus heat input, however Unit #6 is subject to a new source performance standard of 0.50 pounds sulfur dioxide per million Btu of heat input which is more stringent than the state limit; therefore, the state limit will not be placed in the permit.

Table 3-1 displays a comparison of the potential emission rate from Table 2-1 to the state emission limit applicable to Unit #6.

Table 3-1 – Comparison of potential emissions to limits

Unit	Particulates [lb/MMBtu]		SO ₂ [lb/MMBtu]		Comply
	Potential	State Limit	Potential	NSPS Limit	
#6	0.01	0.03	0.05	0.50	Yes

Based on the comparison the units will operate in compliance with the applicable limits.

3.6.2 Performance Tests

Typically, a facility is required to conduct a stack performance test to demonstrate compliance with the particulate matter and sulfur dioxide emission limits. Based on the type of fuel being fired in the boilers, and the comparison in Table 3-1, the Hot Springs Medical Center will not be required to conduct a stack performance test for the state particulate limit, but will have to keep records of the fuel fired in the boiler. The applicable NSPS allows boilers firing distillate to forgo a performance test for sulfur dioxide by maintain certification of the sulfur content in the fuel purchased.

The permit will contain language that allows DENR to require a stack performance test during the term of the permit if an investigation of the facility warrants it.

4.0 RECOMMENDATION

Hot Springs Medical Center in Hot Springs is required to operate within the requirements stipulated in the following regulations:

- ARSD 74:36:05 - Operating Permits for Part 70 Sources;
- ARSD 74:36:06 - Regulated Air Pollutant Emissions;
- ARSD 74:36:07 - New Source Performance Standards;
- ARSD 74:36:08 - National Emission Standards for Hazardous Air Pollutants;
- ARSD 74:36:11 - Stack Performance Testing; and
- ARSD 74:36:12 - Control of Visible Emissions.

Based on information DENR received in the permit application, this air quality construction permit may be issued. Any questions on this review should be directed to Jim A. Anderson, Engineer II.